

Offshore Environmental Studies Program

**Fiscal Year FY 2004 – 2006
Studies Development Plan
Headquarters**

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SECTION 1.0 Programmatic Overview

1.1 Introduction

The ESP was initiated in 1973 as a means to gather and synthesize environmental and social and economic science information to support decision-making concerning the offshore oil and gas program. The Outer Continental Shelf Lands Act of 1953, (OCSLA), as amended in 1978, established policy for the management of the OCS natural gas and oil leasing program and for the protection of marine and coastal environments. Section 20 of the Act authorizes the ESP and establishes three general goals for the program:

- to establish the information needed for assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and the potentially affected coastal areas;
- to predict impacts on the marine biota which may result from chronic, low level pollution or large spills associated with OCS production, from drilling fluids and cuttings discharges, pipeline emplacement, or onshore facilities; and
- to monitor human, marine, and coastal environments to provide time series and data trend information for identification of significant changes in the quality and productivity of these environments, and to identify the causes of these changes.

Early ESP efforts summarized and synthesized available information and early field studies were designed to provide a statistically valid baseline of the geological, chemical, and physical characteristics of proposed leasing areas. Over the years many changes have occurred. Leasing and development activities are now focused predominantly in the Gulf of Mexico, with production in southern California, and, most recently, in Alaska's Beaufort Sea. Studies conducted in these areas are focused on addressing critical OCS information needs as well as characterizing environmental processes. In addition, the ESP has expanded its purview to include environmental issues associated with marine mineral recovery (i.e., sand and gravel) and naturally occurring gas hydrates.

This ESP Studies Development Plan (SDP) provides descriptions of studies that will address MMS national information needs during the next two years. In contrast to the SDPs prepared by the MMS Regional Offices that focus on specific geographic areas, the Headquarters Office SDP emphasizes issues and studies of national scope with program-wide application. The studies fall under the broad areas of general program support (quality assurance, information and data management and dissemination), and physical oceanographic and support studies directed towards oil spill risk assessment (OSRA). The studies in this SDP have been nominated for inclusion by Environmental Studies Branch staff, other MMS Offshore divisions and branches, even Regional Offices who believed that a specific study was more "national" in scope. This year, the plan addresses proposed studies for FY 2004 and beyond.

1.2 Headquarters Research Components

1.2.1 General Program Support and Quality Assurance

Annual support for the activities of the Scientific Committee of the OCS Advisory Board will continue to be provided as a Headquarters Office function. The Scientific Committee has been established to advise the Director of MMS on the feasibility, appropriateness, and scientific value of the ESP. The Scientific Committee reviews and contributes to studies developed by the ESP to address issues and topics of critical concern to the MMS.

In recognition of the benefits of peer-review and to enhance dissemination of environmental information as widely as possible, the MMS routinely provides support to scientific conferences and symposia. In some cases, symposia may have a dedicated session on OCS research; in other cases, OCS sponsored research may be presented within the context of a wider scientific discipline.

Another area of program support sponsored by the Headquarters office has been the archiving of biological specimens. The ESP supports such a program with the Smithsonian Institution, U.S. National Museum as the curator through the Biological Resources Division (BRD) within the U.S. Geological Survey. This project will be recommended by MMS as a priority for BRD to continue funding in FY 2004 and beyond.

1.2.2 Information Management and Dissemination

Rapid information dissemination is a key information management activity. The Environmental Studies Program Information System (ESPIS) has been designed to allow for easy access to ESP products. Full-text files, abstracts, and relational databases are searchable by the system. This allows users to easily search, identify, and select sections of text, or bibliographic citations that relate directly to the desired subject. This system makes the ESP contracted research information directly available to the public and is available through the Internet.

Information standards for reports have been developed so that the text can be directly loaded into ESPIS. Currently, Adobe Portable Document Format (pdf) files are being generated to allow ESPIS to contain graphic information (e.g. graphs, figures, and tables) in addition to the existing text of ESP reports. Ultimately, a GIS interface will be developed to link geographic coverages of ESP research to the ESPIS databases. This will enable users to visualize where environmental information exists in relation to OCS activities.

Information concerning ongoing research supported through the ESP is accessible through an intuitive based web design (<http://www.mms.gov/eppd/studies/index.htm>).

The design is arranged by MMS OCS Region and discipline (e.g., biology, socioeconomics, physical oceanography, modeling, etc) allowing users to concentrate on a single discipline or jump to another with a minimum of links. Information available for each study includes a complete description, status report, cost, and expected date of its final report. Affiliated web sites and presentation abstracts and papers are provided where applicable.

1.2.3 Physical Sciences and Oil Spill Risk Analysis

The Headquarters Office physical oceanographic studies focus on understanding and verifying general physical processes and features common to the OCS. The mechanisms of these processes and features in the ocean and atmosphere control the transport of materials and cause the mixing and redistribution of pollutants. The knowledge and information obtained from physical oceanography and meteorology programs are used in assessing: 1) the transport of spilled oil, 2) the dispersion of discharge fluids and produced water, 3) the movement and spread of air pollutants, and 4) the effects on the migration of marine mammals, the distribution of fishes, and other biological resources.

The MMS is committed to the continuous improvement of its Oil Spill Risk Analysis (OSRA) estimations, and is using the results of field and modeling studies of ocean circulation to fulfill that commitment. The fate of spilled oil is another area of focus. Laboratory analysis is conducted on the various types of oil as well as computer modeling of the behavior of an oil spill in the ocean environment. Furthermore, the ESB staff actively seek cooperative efforts with other agencies and private industries. These efforts leverage MMS's resources, while providing additional needed information.

1.2.4 Social Sciences

The MMS's major legal mandates are the OCSLAA and the National Environmental Policy Act (NEPA). An objective of both laws is to provide the information needed for balanced decisionmaking. Both direct MMS to study the human environment, and both include guidance on social and economic information needs. The ESP's social science research provides information essential to understanding the consequences of OCS-related activities on the populations, economies, and social and cultural systems in areas where the activities occur, it supports MMS's planning and management processes, and provides information for effective interaction with the public about such effects.

SECTION 2.0 Proposed Studies

2.1 Introduction

The following sections focus on the proposed studies for FY 2004, FY 2005, and beyond.

2.2 Profiles of Studies Proposed for the FY 2004 NSL

Table 1. MMS Headquarters Proposed Studies and Ranking for FY 2004

Page #	Topic **	Title	Rank ***
7	OT	MMS Peer-Reviewed Publications from the ESP: A Comprehensive, Annotated Bibliography	1
9	OT	7th International Marine Environmental Modeling Seminar	2
11	PO	Re-examination of Variance, Assumptions, and Statistical Approach to Volume-based Occurrence Rates for Accidental Oil Spills on the U.S. Outer Continental Shelf	3
13	PO	Extended GOM Ocean Current Field for Oil Spill Risk Analysis	4
15	PO	Lagrangian Data Assimilation in Ocean Model Calculations	5
**	PO = Physical Oceanography PS = Protected Species	FE = Fate & Effect SE = Social & Economic	BIO = Biology OT = Other
***	Rank 1 = highest and rank 5 = lowest.		

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2004-2005

Region: Headquarters

Planning Area(s): Nationwide

Type: Competitive

Title: MMS Peer-Reviewed Publications from the ESP: A Comprehensive, Annotated Bibliography

Cost Range (in thousands): \$80 - \$120

Period of Performance: 2004-2006

Description

Background The last comprehensive effort to compile all peer-reviewed publications based on MMS research supported through the ESP was in 1993. This effort contained only the bibliographic information for the articles and produced a database which can link to similar databases containing contractual and final deliverable information. A similar effort, started under the MMS Universities Research Initiative (URI), generated bibliographic information relating to offshore oil and gas development in the form of a quarterly, hard-copy annotated report. This database compilation continued for the 5-year duration of the URI. A continuation of this compilation is being done under the MMS-Louisiana State University Coastal Marine Institute. Information in this latest effort is formatted and searchable on the Internet; however, it does not indicate which articles are based on MMS research.

Objectives The intent of this project is to identify and make available an annotated bibliography of peer-reviewed publications based on MMS ESP research. Identifying and annotating peer-reviewed publications based on MMS ESP studies will help government and industry focus quickly on information collected specifically for the OCS oil and gas, and marine minerals activities. Additionally, one of the Department of the Interior goals is to have all science independently evaluated. Compiling MMS peer-reviewed publications will aid in achieving this goal and help maintain the credibility of MMS science.

Methods The bibliography will be compiled by manually and electronically scanning a variety of literature sources as well as contacting principal investigators for all MMS ESP contracts (focusing on post 1992 contracts). Citations and annotations will be broken down by the following subjects: General Science, Biology, Protected Species, Fates and Effects, Chemistry, Physical Oceanography, Air Quality, Geology, and Socioeconomics. An annotated bibliography will be made available in electronic format that will complement the ESP reports that are currently available via the Internet. Fields will be included in the compilation for title, author, and publisher.

Products Hard copies of annotated bibliography; ongoing digital database.

Importance to MMS The bibliography would serve as an important information source for those assessing potential impacts from OCS oil and gas impacts, as a management tool to determine

how MMS research is being used, and would also help establish and maintain the credibility of MMS environmental research.

Date Information Required: This annotated bibliography would be used on a daily basis by the MMS, and its external customers, as soon as it is available. The last time that this information was pulled together was in 1993. Since then MMS has encouraged and funded the peer-reviewed journal publication of the vast majority of its ESP research. These articles exist in widely scattered areas and in an ever-increasing number of publications. This bibliography represents a major effort at synthesizing the information and annotating it in a readily available context.

Revised Date: 03/03

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2004-2006

Region: Headquarters

Planning Area (s): Generic – Applicable to All Planning Areas

Type: Cooperative Agreement / Interagency

Title: 7th International Marine Environmental Modeling Seminar

Cost Range (in thousands): \$120 - \$180

Period of Performance: FY 2004

Description:

Background Since 1997, the MMS has co-sponsored the annual International Marine Environmental Modeling Seminar (IMEMS), which brings together individuals from governments, private corporations, and academia involved in research on, or applications of, models to understand, analyze, or predict human impacts on the marine environment. First priority has generally been given to papers discussing interdisciplinary or coupled physical-chemical-biological applications, since these tend to represent expansions beyond the traditional limitations of a single discipline. Presentations on mitigation procedures, data visualization methods, and linkages to geographical information systems (GIS) have also been encouraged. The seminar participants make formal oral presentations or poster presentations of their recent work. Informal discussions take place between the presentations and at social gatherings for the participants. Written proceedings of the presentations are produced prior to each seminar, and contributions passing a peer-review cycle are published in the peer-reviewed literature after the seminars.

Some previous seminars had a dominant theme, while others were more open-ended, receiving papers on a large variety of topics. The organizers sought the most current developments and applications as well as recent model verification or model comparisons, and past IMEMS have been reasonably successful at attracting such contributions. On the other hand it should be noted that a great many other researchers and applications-oriented technical individuals with much to contribute have not attended these meetings.

The seminars gave the MMS the opportunity to present its modeling efforts for critical, peer review and to learn about related, new developments occurring in other countries. Such exposure allows MMS to improve the environmental impact modeling it routinely performs.

Objectives There are two objectives of this study, one primary and one secondary. The primary objective of this study is to conduct the IMEMS in 2004 with significantly increased participation over that of previous years and focused on North American coastal waters. The proposed title of the focused seminar is: “Environmental Modeling in North American Coastal Waters for Environmental Impact Assessment, Resource Management, and Mitigation”. The secondary objective will be the production of a book of selected papers from recent IMEMS and possibly peer-reviewed journals summarizing the state-of-the-art in modeling of the marine environment.

Methods To achieve the objective, substantially expanded MMS funding over that of previous years (\$6,000 annually) would be required and the seminar would be conducted in Washington, DC. Co-sponsors would be aggressively sought from the oil and gas industry and environmental consulting firms who have contributed in the past and from those who have not. An aggressive advertising campaign would be launched targeting academic, commercial, and governmental institutions with programs involved in environmental modeling development or applications.

The venue of Washington DC offers two benefits. It is easily accessible from Canada and Mexico, where quality research has been done and where environmental issues overlap those of the United States. We share common waters and need to work together for a healthy, viable marine environment in those waters. In addition, U. S. governmental agencies can more easily participate.

Importance to MMS Environmental impact assessments are an important part of the offshore oil and gas leasing program. An important component to the assessments is environmental impact modeling such as oil spill contact modeling and determining the toxicological effects of oil spill contact. The IMEMS allow MMS's methods to be critically reviewed by knowledgeable colleagues and offers an opportunity for MMS personnel to learn about new methods and models.

Date Information Required: FY2004 This study will improve MMS's environmental impact assessments by expanding the Agency's knowledge and updating its environmental modeling.

Revised Date: 03/03

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2004-2006

Region: Alaska

Planning Areas: Beaufort and Chukchi Seas

Type: Competitive or Contract Modification

Title: Re-examination of Variance, Assumptions, and Statistical Approach to Volume-based Occurrence Rates for Accidental Oil Spills on the U.S. Outer Continental Shelf

Cost Range (in thousands): \$160-\$240 **Period of Performance:** FY 2004-2005

Description:

Background The Oil-Spill Risk Analysis (OSRA) model is undergoing statistical review by multiple stakeholders in the Alaska OCS. The OSRA model was developed by the U.S. Geological Survey in the early 1980's. This model, with minor modifications, is still used today by the Minerals Management Service. The U.S. Outer Continental Shelf (OCS) historical platform and pipeline crude oil spills are mostly from the Gulf of Mexico OCS. The original analyses found that large accidental oil spills, those of at least one thousand barrels, could be treated as a Poisson distribution. That distribution is generally applicable to rare, random events. Subsequent years have demonstrated a decrease in spill rates for platforms and tankers, but not pipelines, demonstrating that spill probabilities are not a pure Poisson process. This approach has worked well for MMS, and rate calculations have been updated every few years in the peer-reviewed literature.

Recent criticisms, however, have suggested that the cumulative spill record now available does not follow the Poisson distribution and have stated that MMS must do a better analysis and reporting of sources of variance and magnitude of confidence intervals for spillage estimates. A full study of sources of variance and confidence intervals in oil spill occurrence estimators has not been attempted by MMS in the past because of limited data availability and the small size of the data set. The MMS has worked hard to improve spill data sets along with associated infrastructure data sets. Original statistical findings and assumptions merit reanalysis with the improved and longer data string. The MMS can re-evaluate assumptions of Poisson distribution for large spills, reconsider the suitability of pipeline length or blended spill estimators, and develop confidence intervals for spill occurrence estimators used by MMS.

Objectives The objective is to reanalyze OCS spill data with purpose of improving the historical MMS spill risk statistical approach:

1. Re-evaluate whether the Poisson distribution is still the best choice for modeling the frequency of occurrence of large OCS spills.
2. Re-examine whether volume-based estimators are still the most precise statistical approach to estimating oil spill occurrence rates.
3. Examine and document all major sources of variance in estimating spill occurrence rates.

4. Statistically evaluate the effect of occurrence of a major spill on subsequent likelihood of a major spill (memory effect).

Methods

1. Develop understanding of: a) historical statistical approaches; b) MMS rationales for estimating oil spill occurrence rates; and c) possible sources of variance through a kickoff meeting with MMS (in Herndon, VA) and further discussions with MMS staff.
2. Statistically re-evaluate use of Poisson distribution, volume-based spill estimators, and spill sizes used in statistical analysis, taking into account the historical MMS approach and MMS's updated database.
3. Statistically investigate and calculate measures of variability, such as confidence intervals, standard deviation, and/or standard errors, for identified sources of variance. Sources of variability are numerous and include scenario assumptions (oil volume to be found and produced, pipeline miles, production rate, etc.), estimates of in-place pipeline miles, etc., geologically-modeled risked and unrisked resource estimates, reserve estimates, estimates of spill size, completeness of the spill data set, etc. The contractor will have multiple meetings with MMS experts who monitor or derive this information for MMS in Anchorage AK, New Orleans LA, and Herndon, VA to help develop a better understanding of the sources of statistical error and issues. The contractor will develop and populate database structures necessary to capture sources of statistical error not currently being addressed by MMS.
4. Examine occurrences of spills subsequent to major spills. Determine the validity of the assumption that spills are statistically independent (randomly occurring) events on local, regional, and worldwide bases. Develop a statistical model of overall spillage on rate and rates specific to large spills that take into account the results of this analysis.
5. Develop user-friendly models and/or algorithms to allow MMS staff to recalculate the contractor's measures of variability as additional information or data become available.
6. Provide professional support to MMS in regard to statistical issues of occurrence rates and estimator(s) related to this study and its results.

Importance to MMS The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's, environmental assessments, and oil-spill-contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EIS's in the Alaska OCS Region.

Date Information Required: Information from this study will be used OCS-wide in the future oil and gas lease sale assessments, future developmental EIS's, and review of oil-spill-contingency plans for OCS and coastal facilities.

Revised Date: February 2003

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2004-2006

Region: Headquarters
Planning Area: Gulf of Mexico Planning Area
Type: Competitive
Title: Extended Gulf of Mexico Ocean Current Field for Oil Spill Risk Analysis

Cost Range (in thousands): \$375 - \$450 **Period of Performance:** FY 2004 - 2006

Description:

Background MMS's oil spill risk assessment modeling has benefited greatly by improved modeling of the surface ocean currents of the Gulf of Mexico (GOM), producing more realistic ocean currents than MMS has used in the recent past. Using data assimilation techniques (assimilating sea surface height), Princeton University investigators developed a high-resolution, GOM, surface current field, that compares fairly well with the trajectories of satellite-tracked, surface drifters. However, even this improved field leaves much observed variability unaccounted. The integrated effect of which can result in simulated transport of oil spills diverging considerably from what would occur in real spill events, thereby reducing the realism of MMS's oil spill risk analysis. Moreover, since the Princeton University modeling effort relied on sea surface height assimilation, their surface current field is limited to only 9-years duration, the time over which sea surface height observations existed. This comparatively short record limits the statistical significance of the oil spill trajectory simulations performed in MMS's risk assessment modeling using that ocean current field. In particular, only a few of the dominant Loop Current Eddies (LCEs) will develop during the 9-year record.

Another recent, pertinent development in the modeling of the GOM ocean currents are the process studies performed by Accurate Environmental Forecasting, Inc. (AEF) under contract to MMS. AEF investigated the effects of bottom topography on the propagation of mesoscale eddies in the GOM, which often dominate the surface circulation. Using conceptual models and fully realistic general circulation models, they were able to reproduce observed eddy movement in the northwestern GOM and in the northern GOM near and inside the Desoto Canyon. In additional, related studies, they determined that correctly modeling topographic effects produces more realistic eddy motion, thus reducing the need for sea surface height assimilation.

A model combining the data assimilation of the Princeton modeling effort and the topographic interaction physics of AEF could produce much better ocean currents for MMS's oil spill risk analyses than either approach alone. In addition, if proper inclusion of the topographic interaction physics of AEF would permit accurate reproduction of the observed LCE variability in the GOM without data assimilation, reasonably realistic ocean current fields could be produced over a much longer period of time than the 10 years over which we now have usable sea level height information (1993 through 2002). Credible wind fields over the Gulf of Mexico covering multiple past decades exist and could be used to drive a circulation model of the GOM incorporating these topographic interactions. The reanalysis of historic meteorological data

performed by the National Center for Environmental Prediction (NCEP) covers the previous 50 years. Using their reanalysis, a 50-year time sequences of wind and ocean currents could be produced for MMS's statistical estimates of oil spill contact risk, giving enhanced statistical significance over estimates derived from shorter wind and ocean current fields. Sea level height assimilation could be used additionally, over the 10 years during which that information exists.

Objectives There are two objectives of this study. The first is to develop an ability to reproduce the observed mesoscale eddy variability in the GOM using a state-of-the-art numerical model **without** resorting to data assimilation. The key evaluation criteria for this objective would be the comparison of averaged sea surface height produced by the model without data assimilation and observed sea surface height from satellite altimeters. The improved representation of the eddy variability will likely improve the model performance **with** data assimilation, since less correction will be necessary. Then, the model would be developed to include the assimilation of observed sea surface height and operated with that additional data assimilation capability. Ocean drifter data and moored current meter data would be used as the ground-truth against which the data assimilating model results would be compared. The second objective is to produce a three-dimensional ocean current field for oil spill risk analyses, over as long a period of time as possible, with the model employing both an assimilation of sea level height and the best possible physical modeling of the interaction between mesoscale eddies and the bottom topography of the GOM.

Methods The contractor awarded this study will select the state-of-the-art model and will justify the selection in their proposal. The selected model must be capable of both a reputable data assimilation method to assimilate sea level height fields and a credible modeling of the interaction between mesoscale eddies and the bottom topography of the GOM continental shelf slope and rise. The contractor will provide evidence that the selected model is capable of both of these. Observations of ocean currents in the GOM from moored current meters and surface drifters obtained from MMS-funded studies will be provided to the contractor, who will use these observations to compare against their model-generated currents. The contractor may use any additional data for model initialization and verification as they see fit and must obtain the sea level height fields and wind fields themselves as well as any other needed data such as other meteorological data and river input. With these data, the model will be run with and without data assimilation or topographic interaction considerations to achieve the objectives stated above. The contractor will make scientifically credible model-observations comparisons.

Importance to MMS Environmental impact assessments are an important part of the offshore oil and gas leasing program. An important component to the assessments is the statistical estimation of the risk of oil spill contact. The correct modeling of the surface ocean currents is essential for credible estimates of oil spill contact risk. This study has the potential to give MMS an ocean current field sufficiently improved over our existing fields to justify its cost.

Date Information Required: The results of this study will be important to improve the Oil Spill Risk Analysis in the Gulf of Mexico. The ongoing sale schedule and development of oil and gas will require future improvement of the OSRA model.

Revised Date: 03/03

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2004-2006

Region: Headquarters

Planning Area(s): National

Type: Competitive

Title: Lagrangian Data Assimilation in Ocean Model Calculations

Cost Range (in thousands): \$ 200 - \$300

Period of Performance: (2004-2005)

Description:

Background The Minerals Management Service (MMS) maintains the Oil Spill Risk Analysis (OSRA) model for the analysis of possible oil spill impact from offshore oil and gas operations. The OSRA model produces estimates of oil spill transport and contact to biological and economic resources using historical records of oil spills, winds, and ocean currents. The circulation of the Gulf of Mexico has been studied through ocean model simulations. These studies delivered current fields simulated by the models, using wind forcing and river input for the period 1986-1999. The MMS conducted field programs, particularly in the Northern Gulf of Mexico from 1993 through 1999, particularly in the LATEX area, the DeSoto Canyon area, and on the West Florida shelf.

Objectives The objective of this study is to perform additional simulations of the circulation of the Gulf of Mexico using an ocean model, which has significant skill in simulating the near-surface currents, using data assimilation techniques employing both satellite altimeter and Lagrangian observations (drifting buoy data). The improvement of the simulations with the addition of the Lagrangian data assimilation will be estimated. The results would be used to estimate the potential improvements to the OSRA model, in cases where Lagrangian data are available.

Method This study would involve the use of a numerical ocean model simulating the current fields of the Gulf of Mexico, using data assimilation techniques employing both satellite altimeter and Lagrangian observations (drifting buoy data). The wind forcing will be derived from the products of an atmospheric model. Skill assessment comparisons against field observations (i.e. current meters and drifting buoy velocities) will be performed.

Products The products of this investigation will be a set of near-surface current fields that will be utilized in the Oil Spill Risk Analysis, and a report that details the properties of the additional runs.

Importance to MMS The results of the study will be used by MMS to improve the OSRA estimates of oil spill trajectories. The existing ocean models have been shown to have skill in estimating the near surface currents. This study will investigate the modification and improvement of simulated currents based on data from field projects that have been conducted in

the Gulf of Mexico. The resulting methods will improve ocean modeling and subsequently the OSRA calculations. .

Date Information Required: The results of this study will be important to improve the Oil Spill Risk Analysis in the Gulf of Mexico. The ongoing sale schedule and development of oil and gas will require future improvement of the OSRA model.

Revised Date: 03/03

2.3 Profiles of Studies Proposed for the FY 2005 NSL and Beyond

Table 2. MMS Headquarters Proposed Studies for FY 2005 and Beyond

Page #	Topic **	Title
19	FE	Analytical Methods/Protocol to Effectively Test for Potential PAH's in Marine Mammals and Fish Tissues: An Information Synthesis
**	PO = Physical Oceanography PS = Protected Species	FE = Fate & Effect SE = Social & Economic BIO = Biology OT = Other

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2004-2006

Region: Headquarters

Planning Areas: Generic-Applicable to All Planning Areas

Type: Joint Funding/Interagency

Title: Analytical Methods/Protocol to Effectively Test for Potential PAH's in Marine Mammals and Fish Tissues: An Information Synthesis

Cost Range (in thousands): TBD

Period of Performance: FY 2005-2006

Description:

Background Exposure to petroleum might result in internal uptake of PAH's by marine mammals and fishes. Such uptake from ingestion, inhalation, or tissue absorption can be estimated post hoc through measurement of PAH's and PAH biomarkers in selected tissues. Identification of a effective protocol(s) for quantifying petroleum exposure in fresh and archived specimen material would help MMS and others to reliably and accurately evaluate trace levels of PAH's, PAH metabolites, and P-450 between marine populations, species, and localities. The issues of concern here include: Can the level of PAH exposure in cetacean and fish tissue, and the sources, be accurately estimated? What tissues should be evaluated, what are the impacts to the marine species, and what impacts are possible if the tissues are consumed by humans? The MMS Pacific, Alaska, and Gulf of Mexico OCS Regions all include cetacean species and commercially valuable fish that need to be protected and which may require mitigating measures. With the OCS industry moving onto the Alaska OCS, into deeper waters of the Gulf of Mexico, and considering the aging structures on the California OCS, it could be a judicious time to assess appropriate methodologies and whether there are PAH and PAH biomarker levels of concern in marine mammal and fish species, the sources of these materials, and what standardized techniques and methodologies are needed to identify and quantify petroleum exposure.

This study would review and synthesize information on available and developing state-of-the art analytical methods for determining PAH and PAH biomarker levels in marine mammal and fish tissues. Information would also be collected on alternative test methods and their advantages or disadvantages identified.

Interagency support for this project would be sought from other responsible authorities such as NOAA and/or EPA which may have post-spill damage assessment responsibilities under respective enabling legislation.

Objectives The overall goal of this proposed study is to conduct a search and synthesis of the available information on the protocols for testing for oil-spill-related PAH's and PAH biomarkers in cetacean and fish tissues. Specific objectives for meeting this goal include:

1. Review literature to document the most reliable and effective alternative chemical/biochemical analytical methods for measuring PAH and PAH biomarker levels in cetacean tissues such as the integument, blubber, bile, gut, etc.
2. Identify advantages and disadvantages of alternative test methods in terms of potential confounding or uncontrolled variables, sources of error or reliability factors. Make recommendations regarding needed improvements in laboratory methodology, standards, processes, and analysis approaches.
3. For all objectives, coordinate with ongoing work in other related MMS-sponsored or other related studies.

Methods An extensive search of the published literature and unpublished data sets, reports and manuscripts, will be performed. Recent and ongoing research will be identified. Trends in methodology should be characterized. Pertinent resources should be annotated and developed as a large digital database.

Products A searchable, annotated bibliography, final report, data sets, and visuals. Hardcopies of all resources identified in the bibliography should be included.

Importance to MMS The potential for tainting of subsistence-harvested cetaceans and other marine mammals and fishes from spilled oil is a frequent concern of some coastal residents. In the unlikely event of large oil spills, a variety of marine mammals and fish species could be exposed, thereby potentially affecting subsistence foods. The results of this study would allow MMS and/or other agencies to monitor PAH levels and PAH biomarkers in cetacean and fish species that might contact spilled oil and to correlate potential contaminant loading with any sublethal effects observed.

Date Information Required: The results of this study could lead to additional adaptation of methodology and technology work. These improvements or advancements could be used by Federal, local, and State authorities responsible for assessing and monitoring effects of oil spills subsequent to such events. In addition, these methods would also potentially be used to update oilspill response manuals in various OCS regions as well as be used in future MMS-sponsored studies of cetaceans when needed to augment available information for cumulative effects assessments related to future proposed lease sales in the Draft Outer Continental Shelf Oil and Gas Leasing Program 2002-2007 (July 2001).

Revised date: 03/03

SECTION 3.0 Topical Areas for FY 2006

This section describes program activities and emerging issues and concerns that are likely to lead to information needs and research in FY 2005 and beyond.

3.1 Physical Oceanography

Future physical oceanographic studies are expected to be directed towards improving the oil spill risk analysis process by incorporating observational data into the risk assessment methods and by improving ocean current modeling. The ESB will continue to support programs that provide a better understanding of current transported spilled oil via simulation modeling and surface drifter observations. Areas of study will include the eastern Gulf of Mexico; the Santa Maria Basin/Santa Barbara Channel, California; and nearshore Beaufort Sea and Cook Inlet, Alaska.

3.2 Information Management

The MMS Technical Information Management System (TIMS) provides the basic state-of-the-art geographic information system (GIS) tools to store and analyze spatial data. Over the past several years the MMS has developed an environmental data structure known as the Coastal and Offshore Resource Information System (CORIS) as the environmental component of TIMS. CORIS is modeled after the Gulf-Wide Information System developed in the GOMR and several environmental GIS pilot projects were undertaken to test the data structure.

The development of this data structure and the environmental data it contains is an on-going effort. The database design is flexible and allows for new data input from environmental studies and other data sources. In addition, appropriate environmental data analysis tools that exploit the query capabilities of a fully relational database structure will create the ability to conduct comprehensive environmental analyses. Basic tools (i.e. ArcView and ARC/Info) make these analyses available in an "expert friendly" form. Customization of these basic tools can create a "user friendly" interface, putting the power of GIS into the hands of all MMS analysts.

3.3 Social Sciences

Oil and gas industry complexity and change continues to be an important issue. How it functions as an organizational system and affects social structure should be documented in order to understand the social affects this may have on employees, their families and the communities that are tied to or are in proximity to oil and gas development. Closing the gaps and making the connections between industry actions and effects on human communities enables MMS to look across localities, regions and nations and observe impacts. To do this several types of information are needed. First, the U.S. is one of the few developed nations that does not keep a labor force demography (because there are no requirements to do so). Considering the

magnitude of the contractor workforce and the global nature of the industry, information is unavailable on the number of offshore workers and the demographic breakdown of the workforce; i.e. women, minorities, etc. Second, we need to document “best practices” of industry and compare these practices across national boundaries. Third, communities are affected by offshore development depending on how and if they have historically evolved with industry. In times of change, communities may need to diversify their economic base. Their options for community development and their capacity for change are important to understand. Fourth, research has documented similar affects on communities from OCS activity across nations. Therefore, more comparative studies among developed and undeveloped countries would certainly prove valuable. Fifth, research workshops are a valuable source of information collection and dissemination. Finally, labor mobility, shortages and employee loyalty are questions of concern to the industry. Many of these issues have no national boundaries. Because oil and gas is a global industry issues such as downturns, employee shortages, loyalty and community impacts exist no matter where the industry operates.

3.4 Hydrates

There has been increasing interest in the last few years in the recovery of gas hydrates from the OCS as a source of natural gas. Exploration into the location and distribution of gas hydrates along the continental slope of the Gulf of Mexico is presently underway with federal government and industry partnerships. Within the next five years, this could lead to the possible commercial extraction of hydrates. At the national level, the Environmental Studies Program will continue to seek opportunities to collaborate with other agencies and industry in hydrate research projects that contribute to our knowledge of the marine environment that could be affected by the development activity. This approach is intended to allow us to achieve a highly leveraged investment for our limited research dollars. Complementary to collaborations at the national level, the Regions will develop local area-specific environmental studies to meet the information needs of resource managers in the region. Our vision will support MMS mission and long-term goals and DOI goals focusing on environmentally sound development of our nation’s natural resources.